the crushing weight is about 59 kilogs. per cent. square.*

At Vernon, in the department de l'Eure, a species of indurated chalk is largely quarried for local uses. The church of Vernon, and that of Louviers, are executed in this kind of stone, as are also those of Pont de l'Arche, and of les Andelys. When fresh from the quarry these stones are soft, but they harden by exposure to the atmosphere; so much so as to resist atmospheric action in a very extraordinary manner. In the instances of the three first-named churches, all the external ornamentation is of the most elaborate character of the "flamboyante" architecture; and in all cases where the water does not lodge, the details of the foliage, and the arrises of the mouldings, are preserved in a very remarkable manner. The blocks are sometimes 3 feet 4 in. high; their specific gravity is 2·155; the foot cube weighs 135 lbs. nearly, the crushing weight is about 220 kilogs. per centimètre square.†

A similar description of indurated chalk is extracted at Caumont, in the Seine Inférieure, to the north-west of Rouen. This, or a like stone from St. Etienne, nearer still to the town, was much employed in the middle ages in the buildings of Rouen. The cathedral, St. Ouen, St. Maclou, the Archbishop's palace, may be cited as instances.

The lateral elevations of the Madeleine are of the Pierre Franche of l'Ile Adam, the upper parts of St. Vincent de Paul, of N. D. de Lorette, of Vergelée de St. Leu; those of the Palais du Quai d'Orçay, are a mixture of the pierres franches of Carrières St. Denis, Montesson, and Carrières sous bois, near St. Germain. The façades of the Bourse are in stone of l'Ile Adam and of Conflans. The restoration of the Palais de Justice, the completion of St. Ouen, the upper parts of the Douane and of Entrepôt des Sels, at Rouen, are in Vergelée de St. Leu.

At Havre, and generally in the embouchure of the Seine, the calcareous stones of the Calvados are used. An examination of them would lead us into too many details at present; but they have become so interesting to us, from the extensive use made of them in England, that it is much to be desired that a more elaborate examination be made than we have at present. The notices contained in THE BUILDER, notwithstanding their undoubted merit, present questionable points. The chemical analysis, firstly, I am convinced, is not correct; inasmuch as the Caen stone is stated only to contain *a trace* of magnesia, whilst it is notorious that the lime it yields is thin, without being hydraulic, which would not occur unless there were present a very considerable quantity of magnesia.‡ The use of the franc banc is justly objected to, but the use of the stone from the quarries of la Maladrèrie is much more dangerous, and this, I observe, is sent over to London in very large quantities. It is, if not asserted, at least given to be understood, that no inconvenience would arise from the use of Caen stone placed the wrong way of the bed; whereas all the most accurate and scientific observers who have made any researches into the subject—namely, Rondelet, Soufflot, Peyronnet, Ganthey, Sganzin, Reibel, and Vicat,—all agree in asserting that the resistance of stones is much greater when they are employed upon their natural bed. As to the action of the sea water upon the Caen stone, it is universally received amongst the French practical masons that the sea water destroys it very rapidly; and chemistry teaches us that the muriates and sulphates of magnesia, present in the sea water, enter into energetic combination with the salts contained in the limestones, and produce rapid disintegration.*

Practically, at Paris, where from the nature of the subsoil it is expensive to form cellars, and where the bulk of the houses are built upon the ground, without deep foundations, where the land is all freehold, building leases are unknown, and consequently where the interest of the proprietors is evidently to obtain the greatest number of dwellings upon the least possible surface, and the houses, therefore, are generally from six to seven stories high, the lower parts of the houses are built of the roche stone, towards the street and up to the first floor; from thence two stories are carried up in la pierre franche; and the remainder is executed in lambourde. The party walls are mostly executed of moellon, or small coursed stones, of similar natures to the corresponding parts of the façade. The back walls and partitions are of wood, filled in with light rubble, and plastered. Such construction is about as bad as can be: the front wall, built of carefully-squared ashlar, sinks very little. The party walls, of rubble and plaster, not only sink more than the front, but, from the fact that the plaster in setting expands, it becomes necessary to build these walls totally independent of one another. The back walls, of wood framework, shrink still more. It is therefore almost impossible, in the new quarters of Paris, where this style prevails, to find a house which is not disfigured in all directions with cracks and settlements of every kind and size imaginable.

The mode of using the stone is, however, logical, and merits imitation. The harder and less hygrometric stones are placed at the bottom, as being the most fit to resist the crushing weight and the capillary action of the stone upon the humidity of the soil. The finer grained stones are employed at the heights destined usually to be ornamented; the lighter and more perishable stones are used above, where they load the foundations less than the others would do, and where they meet with the atmospheric conditions the most adapted to their own preservation.

In Rouen, the Chèrence stone, or that of Vernon, are used in the situations where the roche is used at Paris; the upper parts are of the softer stones. At Havre the same rule is observed: the Chèrence, Caumont, Ranville, or granite, are used in all cases where there is danger to be feared from humidity; the Caen stone is only used in the upper works. Wherever I have seen the Aubigny stone used, it has decayed rapidly. Indeed, the French architects do not much advocate its use externally.

3rd. *The Gypseous Stones.*—These stones, from their soft and friable nature, and the facility with which they decompose in the atmosphere, are not allowed to be used as building materials in Paris. Sometimes enclosure walls are built of them, employed as moellon. The principal use is in the fabrication of plaster.

The chemical nature of these stones as found at Montmartre, Belleville, Charonne, Menilmontant, le Calvaire, Triel, and Meulan, is, according to Foureroy, 32 parts oxide of calcium, 46 parts of sulphuric acid, and 22 parts of water. They differ from the gypsums of other countries in the large quantities of lime they contain, which gives them greater powers of resistance to the action of the moisture of the atmosphere. The operation of burning consists simply in driving off the water of crystallization. In this state the plaster has a remarkable avidity for water, and immediately that any is presented it absorbs it, and crystallizes around the bodies in its immediate vicinity. I noticed previously the singular fact of the swelling of the plaster during this process; it is one that requires great attention in the employ of the material. Another fact worthy of notice is cited by Rondelet, namely, that two bricks set together with plaster adhere with one-third more energy than bricks set with lime during the first month; but that afterwards their adhesion diminishes, whereas that of the bricks and mortar increases almost indefinitely.*

4th and 5th. *The Silicious Stones, &c.*—They comprehend the grès, flint nodules, the meulières, the granites, porphyries, and the basalts.

The grès is a species of imperfect sandstone formation, at least as it occurs near Paris, and in the department of the Lower Seine. It is composed of a fine sand of a whitish tinge, cemented together by a silicious cement. Generally speaking it occurs in detached nodules, named "rognons;" sometimes it occurs in layers of different thicknesses. The quarrymen observe that the lower they descend the softer the grès becomes, and that the harder nature of stone is the most easy to quarry in regular forms. It has no definite planes of stratification or crystallization, and is therefore easily worked into any shape required. The streets of nearly all the towns between Paris and the sea-board are paved with these tertiary grès, which occur in isolated patches along the whole course of the river. At Havre, of late, the red sandstone of May, near Caen, a member of the Cambrian system, has been employed instead thereof, with remarkable success. The usual size of the paving stones is 9 inches square; but some of the last works of this kind have been executed with narrower stones, about 4 inches wide.

The flint nodules are sometimes used for rough rubble masonry. They occur in chalk and in the gravels overlying the tertiary formations.

The meulière is a species of quartzose concretion, with numerous small holes. It is met with in two forms; one which occurs in masses sufficiently large to form millstones of one piece; the other in detached nodules scattered over the country. The principal quarries of the first, for the supply of the Paris market, are at Montmirail (Marne) and la Ferté sous Jouarre (Seine et Marne). The second sort are found nearer Paris, and in the department de l'Eure.

As the meulière is excessively hard, and resists all external action in the highest degree, it is much used by engineers and architects in situations where those qualities are required. The fortifications of Paris and of the detached forts are faced with it. Many of the works of the Canaux St. Martin, St. Denis, and de l'Oure, the sewers of Paris, and the abattoirs also, are faced with the meulière; for all these works it is admirably adapted. One species is, however, to be avoided,—"la caillasse;" its surfaces are so perfectly even that they offer no key to the mortar.

The granites, a description of which would here be unnecessary, are only used in Paris and the other towns in the interior as borders for the foot-paths, and occasionally as flagging. That used in Paris is mostly extracted at the island of Chaussey, and is of a nature closely resembling the best Devonshire granites. The plinths of the columns of the Law Institution in Chancery-lane† are of this granite, and may give a correct idea of its nature. The enormous cost of the granite, owing to the land carriage, must at all times limit its use in the interior. At Havre, however, and at Honfleur, it is much used in the different docks, and the fortifications towards the river are entirely faced with it.

The porphyries are very little used, nor do they occur abundantly in any position suitable

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* The chemical type of the building stones of Paris may be regarded to be that of the stones found near Marly; they are thus composed—

Carbonate of lime	89
Magnesia	1
Silicate of ammonia	10
Total	100

Sometimes the magnesia disappears, and the quantity of clay and flint diminishes considerably; thus it is—

Carbonate of lime	0·985
Silex and clay	0·015
	1·000

Berthier.

† The most correct chemical analysis of the chalk in the department of the Lower Seine was made upon some extracted at St. Catherine. It is more fissured than at Vernon, St. Etienne, or Caumont, but may be regarded as of the same mineralogical type. It contains—

Carbonate of lime	66
Silicate of ammonia	13
Sand	6
Oxide of iron	2
Water	13
	100

‡ The name of Professor Phillips, by whom the analysis was made for us, should be a sufficient guarantee of its correctness.—ED.

* The calcareous stones when first extracted are certainly in a very different state to that in which they appear after losing the quarry damp, to use the expression of the quarrymen. I suspect that they exist in the quarry only as a subcarbonate of lime; at any rate, it is certain that they are hydro-carbonates. In either case the lime is, comparatively speaking, free to enter into new combinations. If sea water be introduced, the magnesia enters into combination with the lime, the more readily if carbonic acid be present, giving rise to the formation of a magnesian carbonate of lime. The sulphuric acid gas also enters into combination with the lime, giving rise to the formation of sulphate of lime. These combinations take place with the commencement of a confused crystallization, the mass is disintegrated, and falls to powder.

* The value of the building materials extracted in 1841 was, for the departments before cited, as follows:—

	Building Stones.	Plaster.
Seine and Marne	F.647,000	F.750,000
Seine	2,413,312	1,325,667
Seine and Oise	1,378,576	504,589
Seine Inférieure	169,595	
Eure	121,950	108,784
Calvados	837,351	
Orne	900,600	146,250

besides the value of the slates, quoted previously.

† That is to say, of the columns of the portico.

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